

## LIVERMORE LAB REPORT

A weekly review of scientific and technological achievements from Lawrence Livermore National Laboratory, Nov. 18-22, 2013.

### TIME AN EYE ON INVENTION



**The Argus II artificial retina, in which Lawrence Livermore has played a prominent roll, has enough resolution for people to see the lines of a crosswalk, find objects and read letters a couple of centimeters tall. Image by Dan Foley/Second Sight Argus II.**

The artificial retina, in which Lawrence Livermore has played a prominent role, has earned a place in the top 25 best inventions of the year 2013 from *Time Magazine*.

This Department of Energy-funded project resulted in the creation of the first-ever retinal prosthesis -- or bionic eye -- approved in the United States by the U.S. Food and Drug Administration for blind individuals with end-stage retinitis pigmentosa. The multi-institutional team that developed the artificial retina received a *Popular Mechanics* Breakthrough Award in 2010. In 2009, the team also received an R&D 100 Award from *R&D Magazine*.

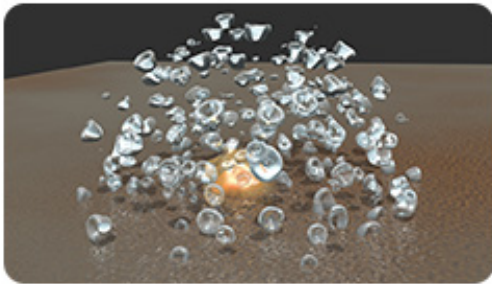
The LLNL team contributed three major components to the artificial retina program: the thin-film electrode array that contains the neural electrodes; the biocompatible electronics package that contains the electronics for stimulating the retina and wireless power and communication; and an ocular surgical tool that will enable the replacement of the thin-film electrode array. In addition, LLNL was responsible for the system integration and assembly of the next-generation artificial retina system with 240 stimulating electrodes.

The invention was commercialized by Second Sight and is now called the Argus II, which gives sight to the blind. So far, the Argus has enough resolution for people to see the lines of a crosswalk, find objects and read letters a couple of centimeters tall.

To read more, go to [Time Magazine](#).

**WALL STREET  
JOURNAL**

**TINY BUBBLES MAKES IT BIG**



**Lawrence Livermore scientists and collaborators set a new record in supercomputing in fluid dynamics by resolving unique phenomena associated with clouds of collapsing bubbles. Image courtesy of Petros Koumoutsakos zVg / CSE Laboratory , ETH Zurich.**

Lawrence Livermore researchers, in collaboration with scientists at ETH Zurich, IBM Research and the Technical University of Munich, has set a new record in supercomputing in fluid dynamics using 6.4 million threads on LLNL's 96 rack "Sequoia" IBM BlueGene/Q, one of the fastest supercomputers in the world.

The simulation won a Gordon Bell prize earlier this week at SC13.

The simulations resolved unique phenomena associated with clouds of collapsing bubbles, which have several potential applications including: Improving the design of high-pressure fuel injectors and propellers; shattering kidney stones using the high pressure of the collapsing bubbles; and emerging therapeutic modality for cancer treatment by using bursting bubbles to destroy tumorous cells and precise drug delivery.

To read more, go to the [Wall Street Journal](#).

**SCIENTIFIC  
AMERICAN**

**RAIN, RAIN GO AWAY**



**Lawrence Livermore scientists have found that observed changes in global precipitation are directly affected by human activities.**

For those living in wet areas, that may be a pie-in-the-sky wish. According to a new report by Lawrence Livermore researchers, global precipitation patterns are being moved in new directions by climate change.

In a nutshell, wet areas are getting wetter, dry areas are getting drier and storm tracks are moving toward the poles.

This is the first study to find the signal of climate change in global precipitation shifts across land and ocean. "It's worth saying that this is another grain of sand on that vast pile of evidence that climate change is real and is occurring," said study co-author Kate Marvel, a climate scientist at Lawrence Livermore National Laboratory.

Climate models predict that the addition of heat-trapping gases in the atmosphere will shift precipitation in two main ways. The first shift is in a strengthening of existing precipitation patterns. This is commonly called "wet get wetter, dry get drier." The second shift is a change in storm tracks, which should move away from the equator and toward the poles as atmospheric circulation changes.

To read more, go to [Scientific American](#).



**These breathable membranes have pores made of a few nanometer-wide vertically aligned carbon nanotubes.**

DARPA, the research arm of the United States defense agencies, has been in pursuit of a unique suit for soldiers that would utilize advanced robotics and nanomaterials technology to prevent injury and improve stamina on the battlefield.

One interesting use of advanced nanomaterials for soldiers and military applications comes from the Lawrence Livermore National Laboratory where researchers have developed a fabric from carbon nanotubes that detects and repels chemical and biological weapons.

Francesco Fornasiero, principal investigator for the project, says: "The uniform will be like a smart second skin that responds to the environment." The membrane pores on the "skin" are only a few nanometers wide; biological agents like viruses are ten or more nanometers in size and cannot pass through the barrier.

To read more, go to [AZO nano](#).



**FUSION IN THE FUTURE**



### **A technician checks the diagnostics in the National Ignition Facility's target chamber.**

In the not-too-distant future, nuclear fusion may be achieved. Scientists at the National Ignition Facility (NIF) announced last month that they are very close to a nuclear energy solution.

The scientists at the NIF have nearly achieved nuclear fusion's "break even point," or the point at which the energy put in is equal to the energy produced.

Furthermore, the NIF team has expressed that the remaining barriers to overcome are engineering-related and not physics-related.

To read more, go to [Epoch Times](#).

## **LIVERMORE LAB REPORT TAKES A BREAK**

The *Livermore Lab Report* will take a break for the week Nov. 26-29 due to the Thanksgiving holiday. It will return Dec. 6.

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LLNL applies and advances science and technology to help ensure national security and global stability. Through multi-disciplinary research and development, with particular expertise in high-energy-density physics, laser science, high-performance computing and science/engineering at the nanometer/subpicosecond scale, LLNL innovations improve security, meet energy and environmental needs and strengthen U.S. economic competitiveness. The Laboratory also partners with other research institutions, universities and industry to bring the full weight of the nation's science and technology community to bear on solving problems of national importance. To send input to the *Livermore Lab Report*, send [e-mail](#)